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DRINKING BY PARENTS, SIBLINGS, AND FRIENDS AS PREDICTORS OF REGULAR ALCOHOL USE IN ADOLESCENTS AND YOUNG ADULTS: A LONGITUDINAL TWIN-FAMILY STUDY

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Abstract — Aims: The aim of this study was to examine whether the drinking habits of parents, siblings, and friends were related to regular drinking in adolescents and young adults, cross-sectionally as well as longitudinally. **Methods:** Data of 12–30-year-old twins from the Netherlands Twin Register were analysed. Information on regular drinking was collected in 1993, 1995, and 2000. Logistic regression analyses were conducted on cross-sectional data of 1993 ($N = 3760$), short-term longitudinal data of 1993–95 ($N = 2919$), and the long-term longitudinal data of 1993–2000 ($N = 1779$). **Results:** Results show that age, sex, and one's own previous drinking habits were important predictors of later-life regular drinking. Drinking habits of parents showed small but persistent positive associations. Alcohol use of the co-twin was strongly related to alcohol use of the participants, especially in the cross-sectional analyses, while alcohol use of additional siblings other than the co-twin was relatively unimportant. Cross-sectionally, friends' alcohol use showed a high association with regular drinking, but this association decreased over time. **Conclusion:** Cross-sectional analyses showed that a substantial part (29%) of the variance in regular drinking habits of adolescents and young adults was explained by the drinking habits of family members and friends, in particular, by drinking of co-twins and friends. But, over time, drinking by family members and friends could only explain a relatively small part (4–5%) of the variance in adolescents' and young adults' alcohol use.

INTRODUCTION

Alcohol use in adolescents and young adults reflects alcohol use of family members (e.g. Needle *et al*., 1986; Li *et al*., 2002; Cleveland and Wiebe, 2003; Wood *et al*., 2004). Parental alcohol use is associated with adolescent and young adult drinking in some studies (Green *et al*., 1991; Duncan *et al*., 1996; Hops *et al*., 1996; Koopmans and Boomsma, 1996; Engels *et al*., 1999; Windle, 2000; Li *et al*., 2002; Cleveland and Wiebe, 2003; Wood *et al*., 2004), but not in others (Reifman *et al*., 1998; Beal *et al*., 2001; Boyle *et al*., 2001). Most studies that have explored the influence of parental alcohol use on their offspring's drinking combined maternal and paternal drinking into one overall parental alcohol use score, but did not examine the effect of alcohol use of mothers and fathers separately. Furthermore, studies in which the role of siblings in adolescents' substance use was examined showed that drinking by siblings (Needle *et al*., 1986; Ary *et al*., 1993; Duncan *et al*., 1996; D'Amico and Fromme, 1997; Windle, 2000; Boyle *et al*., 2001), even when biologically unrelated (McGue *et al*., 1996), is associated with alcohol use of adolescents and young adults. Only three of these studies examining the role of siblings' drinking habits in adolescent alcohol use had a longitudinal design, and time periods were relatively short (not more than a 3-year period) (Ary *et al*., 1993; Duncan *et al*., 1996; Windle, 2000).

Not only the drinking behaviour of family members, but factors outside the family may also require consideration. In research on adolescents' substance use much attention is paid to the role of friends. Young people tend to form an identity independent from their families and foster tighter bonds with their friends during adolescence. In general, friends' drinking patterns are considered to be one of the strongest predictors of adolescents' and young adults' alcohol use (Petraitis *et al*., 1995). Friends' drinking is a robust predictor of adolescents' alcohol use, both cross-sectionally and over a short period of time (within a year) (Graham *et al*., 1991; Ary *et al*., 1993; Webster *et al*., 1994; Urberg *et al*., 1997; Reifman *et al*., 1998; Engels *et al*., 1999; Windle, 2000; Beal *et al*., 2001; Wood *et al*., 2001; Andrews *et al*., 2002; Bot *et al*., 2005). However, two longitudinal studies, covering a longer period of time (2 years and 3 years or more), have shown that the influence of friends on drinking is important in early adolescence, but decreases over time (Engels *et al*., 1999; Andrews *et al*., 2002). In addition, in a study over a 1-year period, Jaccard *et al*. (2005) conclude that close friends are less relevant in affecting adolescent drinking than is often assumed.

The behaviour of family members and friends is a relevant contributor to the development of adolescent and young adult alcohol consumption, but it is unclear who most strongly affects changes in frequency of alcohol use over time. The influence of parents, siblings and friends on alcohol consumption is seldom examined simultaneously. In the current study, we examine the influence of alcohol use of parents, siblings, and friends on adolescents' and young adults' regular drinking over time. Furthermore, we examine whether these influences were moderated by age and sex. In addition to the relative impact of alcohol use of parents (fathers and mothers), siblings (brothers and sisters), and friends, we also compare data from Monozygotic (MZ) and Dizygotic (DZ) twins. Because MZ twins are genetically identical while DZ twins share (like non-twin siblings) on

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Table 1. Number of participants in this study derived from the longitudinal twin-family study of the Netherlands twin register

	1993	1993–1995	1993–2000
MZM	628	478	284
DZM	546	412	182
DOSM	513	396	177
MZF	920	749	550
DZF	641	487	338
DOSF	512	397	248
Total MZ	1548	1227	834
Total DZ	2212	1692	945

Note. MZM, Monozygotic males; DZM, Dizygotic males; DOSM, Dizygotic males from opposite sex pairs; MZF, Monozygotic females; DZF, Dizygotic females; DOSF, Dizygotic females from opposite sex pairs.

average 50% of the genes, a higher association between alcohol use of MZ co-twins than of DZ co-twins indicates genetic influences on alcohol use. Our study extends on existing studies in three ways, first, we examine drinking by family members and friends simultaneously, second we focus on differences between cross-sectional and longitudinal analyses, and third, we use twin data.

METHODS

Procedure and participants

Data reported in this study are part of an ongoing longitudinal questionnaire study of the Netherlands Twin Register. From 1991 onwards, families with twins have been questioned about health, lifestyle and personality roughly every 2 years. Twins were asked to participate every time (1991, 1993, 1995, 1997, and 2000), parents in 1991, 1993, and 1995, and siblings in 1995, 1997, and 2000. Some individuals participated only once, while others participated several times. Information about sample and data collection is described in detail in Boomsma *et al*. (2002).

In the present study we used data from the 1993, 1995, and 2000 surveys. At the first wave, the mean age was 17.8 years (SD 3.1) with an age range from 12 to 25 years. Participants were grouped into three age categories: 12–15, 16–20, and 21–25 years. For the cross-sectional analyses of 1993, the sample consisted of 1550 MZ twins and 2213 DZ twins. The sample for the short-term longitudinal analyses consisted of 1227 MZ twins and 1692 DZ twins who participated both in 1993 and in 1995. For the long-term longitudinal analyses, the sample consisted of 834 MZ twins and 945 DZ twins who participated both in 1993 and in 2000 (Table 1 depicts the sample constitution in more detail).

Measures

Participants were asked to report their frequency of drinking by responding to the question: 'How often do you drink alcohol?' This question had eight response categories: (i) 'I do not drink alcohol', (ii) 'once a year or less', (iii) 'a few times a year', (iv) 'about once a month', (v) 'a few times a month', (vi) 'once a week', (vii) 'a few times a week', and (viii) 'daily'. For extensive descriptive information on the distribution of alcohol consumption at each wave see Poelen *et al*. (2005).

For 3457 fathers and for 3738 mothers self-reported data on frequency of drinking were available in 1993. In case data on alcohol use of father or mother were missing, data on alcohol use of 1995 were used, because there was a high stability of frequency of drinking over time (for fathers $r = 0.75$, $P < 0.001$ and for mothers $r = 0.78$, $P < 0.001$). If these data were also not available, we used twin reports on their parents' alcohol use. Correlation analyses showed a sufficient resemblance between twin reports and parents' reports of parental frequency of drinking ($r = 0.71$, $P < 0.001$ for fathers' drinking, and $r = 0.77$, $P < 0.001$ for mothers' drinking). In our sample, 117 twins were from single parent (only mother) families, these families were excluded from further analyses, as data on the father's drinking was unknown.

For 3697 co-twins, self-reported data on frequency of drinking in 1993 were available, missing data on frequency of drinking could be completed by twins' reports on their co-twins' drinking. In 1993, twins were asked about the frequency of drinking of their brother(s) and sister(s) other than their co-twins. Based on these answers, drinking habits of the brother(s) and sister(s) were categorised as: (i) 'one or more brother(s) or sister(s) seldom alcohol', (ii) 'one or more brother(s) or sister(s) a few times a month alcohol', (iii) 'one or more brother(s) or sister(s) a few times a week alcohol' and (iv) 'no additional brother(s) or sister(s)'. In our study 1501 participants had at least one brother besides their co-twin and 1391 participants had at least one sister besides their co-twin.

In 1993 twins were also asked how often their friends drank alcohol. Frequency of drinking by friends was categorised as: (i) 'no drinking friend', (ii) 'a few friends drink', and (iii) 'more than half of the friends drink'. This was answered by 3684 participants.

Data analysis

To examine whether alcohol consumption of family members and friends was cross-sectionally associated with regular drinking of adolescents and young adults, multivariate logistic regression analyses were conducted for the data collected in 1993 (see for similar type of analytic strategy to assess the role of parents and siblings on individual substance use, Vink *et al*., 2003; Harakeh *et al*., 2005). To determine whether drinking habits of family members and friends predicted alcohol consumption of adolescents and young adults in the short term and the long term, we conducted multivariate logistic regression analyses for the short term (1993–95) longitudinal data, and for the long term (1993–2000) longitudinal data. In both longitudinal analyses predictor variables, including drinking by the co-twin, were assessed in 1993 while drinking by twins was assessed in 1995 and 2000.

We aimed to predict regular drinking, therefore frequency of drinking was transformed into (0) non-regular drinking and (1) regular drinking; regular drinking was defined as drinking a few times a month and more. In the cross-sectional analyses age and sex were entered in the model at the first step and in

Table 2. The number of participants (N) and percentage of individuals reporting regular drinking, by age and sex

	Male				Female			
	12–15	16–20	21–25	26–30	12–15	16–20	21–25	26–30
Regular drinking								
1993, *N*	549	842	296	—	663	1010	400	—
Percentage	16.2	70.9	80.4	—	10.7	52.3	53.8	—
1995, *N*	193	682	404	—	266	830	529	—
Percentage	28.5	73.6	80.7	—	23.7	56.1	56.1	—
2000, *N*	—	95	354	185	—	174	581	371
Percentage	—	89.5	86.7	85.9	—	71.8	68.3	58.0

Note: Prevalence rates differed significantly between males and females (Chi-square tests $P < 0.05$) except for regular drinking among 12–15-year-olds in and 1995. Chi-square tests for sex differences ranged from $\chi^2(1, N = 1212) = 7.94$, $P = 0.005$ to $\chi^2(1, N = 1852) = 66.80$, $P < 0.001$. All prevalence rates differed for age groups except for males in 2000. Chi-square tests for age differences ranged from $\chi^2(2, N = 1126) = 14.50$, $P = .001$ to $\chi^2(2, N = 1687) = 496.48$, $P < 0.001$.

the longitudinal analyses age, sex, and respondents' alcohol use in 1993 were entered in the model at the first step, thus, our analyses were controlled for these variables. Both cross-sectionally and longitudinally, the variables regarding drinking by parents, co-twin, additional siblings, and friends were entered in the model at the second step. Interaction terms between drinking habits of family members and friends, and age and sex were entered in the model at the third and fourth step respectively. These interaction terms were used to test whether the relation between family and friends drinking and twins' alcohol use was different for 12–15, 16–20, and 21–25-year-olds, and for males and females.

RESULTS

Table 2 depicts prevalence rates of regular drinking of adolescent and young adult twins. Results show that regular drinking is more prevalent among age groups aged 16 years and older than among 12–15-year-olds (chi-square tests for age differences ranged from $\chi^2(2, N = 1126) = 14.50$, $P = 0.001$ to $\chi^2(2, N = 1687) = 496.48$, $P < 0.001$). Prevalence rates were higher in males than in females (chi-square tests ranged from $\chi^2(1, N = 1212) = 7.94$, $P = 0.005$ to $\chi^2(1, N = 1852) = 66.80$, $P < 0.001$), with the exception of the youngest age group.

Cross-sectional associations with regular drinking

Table 3 shows the results from the cross-sectional multivariate logistic regression analyses. These analyses examined whether alcohol use of parents, co-twin, additional siblings, and friends was related to regular drinking in 1993 after controlling for age and sex. Results show that age and sex were significantly related to regular drinking. Odds ratios indicated that 16–20- and 21–25-year-olds were at higher risk for regular drinking than 12–15-year-olds. Males were at higher risk for regular drinking than females. Further, having a father who drank daily, and having a mother who drank a few times a week or daily, was associated with a higher risk for drinking than having parents who never or seldom drink. Having a co-twin who drank a few times a month and having a co-twin who drank a few times a year was associated with a higher risk for regular drinking than having a co-twin who never or seldom drank. Odds ratios were higher if co-twins drank a few times a month than if co-twins drank a few times a year. Further, an association was found for having one or more additional sister(s) besides the co-twin who drank a few times a month and a few times a week. Drinking by another brother(s) was not significantly related to regular drinking. For friends, it was shown that having a group of friends among whom a few drank alcohol regularly increased the risk for regular drinking compared to having a group of friends among whom no one drank alcohol. This increased risk for regular drinking was even higher when having a group of friends among whom more than half drank.

The cross-sectional model with alcohol use of parents, co-twin, additional siblings, and friends explained 60% of the variance of regular drinking. This was an increase of 29% relative to the model with age and sex.

Longitudinal analyses for regular drinking

As with the cross-sectional analyses, both short-term and long-term longitudinal analyses indicated a strong association between age and sex, and regular drinking (Table 3). The age effects in both longitudinal analyses indicated that participants who were 16–20 or 21–25 years old in 1993 were at lower risk to be regular drinkers in 1995 and 2000 than 12–15-year-olds in 1993. Both analyses pointed out that males were at higher risk to become regular drinkers than females. Furthermore, being a regular drinker in 1993 was an important predictor of regular drinking in 1995 and 2000.

Having a mother who drank a few times a week in 1993 was positively associated with respondents' regular drinking in 1995 and 2000, whereas this association was not found with fathers. The association with a mother indicated that having a mother who drank a few times a week in 1993 was related to a higher risk for regular drinking in 1995 and 2000 compared to having a mother who never or seldom drank in 1993. Both daily drinking of fathers and mothers was related to regular drinking compared in 1995, but not to regular drinking in 2000. Odds ratios indicated that participants with daily drinking parents in 1993 were at higher risk for regular drinking in 1995 than participants with parents who never or seldom drank in 1993. Short-term longitudinal analyses

Table 3. Cross-sectional and longitudinal associations between alcohol consumption of parents, siblings, and friends and regular drinking by adolescents and young adults

	1993		1993–95		1993–2000	
Variable	OR	95% CI	OR	95% CI	OR	95% CI
Step 1						
Age 1993						
12–15 years	1	—	1	—	1	—
16–20 years	2.68***	2.05–3.50	0.67**	0.51–0.87	0.31***	0.22–0.45
21–25 years	2.86***	2.08–3.94	0.38***	0.27–0.54	0.16***	0.10–0.26
Sex						
Males	1	––—	1	—	1	—
Females	0.48***	0.39–0.58	0.56***	0.46–0.68	0.35***	0.26–0.47
Regular drinking, 1993						
Non-regular drinking	—	—	1	—	1	—
Regular drinking	—	—	10.83***	8.28–14.16	6.35***	4.49–8.97
Step 2						
Alcohol use by father						
Never/seldom	1	—	1	—	1	—
Few times a week	1.25	0.96–1.63	1.20	0.92–1.57	0.98	0.70–1.37
Daily	1.47*	1.10–1.96	1.38*	1.03–1.86	1.35	0.93–1.96
Alcohol use by mother						
Never/seldom	1	—	1	—	1	—
Few times a week	1.33*	1.07–1.65	1.37*	1.10–1.71	1.78***	1.34–2.37
Daily	1.49*	1.11–2.00	1.62*	1.20–2.20	1.46	0.99–2.14
Alcohol use by co-twin						
MZ never/seldom	1	—	1	—	1	—
MZ a few times a year	3.52***	2.09–5.91	2.14***	1.48–3.09	1.48	0.94–2.31
MZ a few times a month	27.81***	16.65–46.47	3.09***	2.03–4.72	1.99**	1.19–3.35
DZ never/seldom	2.46**	1.34–4.51	1.28	0.85–1.93	0.97	0.60–1.58
DZ a few times a year	4.74***	2.75–8.17	2.59***	1.72–3.90	1.14	0.66–1.97
DZ a few times a month	19.59***	11.70–32.80	3.29***	2.12–5.10	1.78*	1.04–3.06
DOS never/seldom	3.37***	1.81–6.28	1.50	0.98–2.30	1.60	0.89–2.86
DOS a few times a year	9.20***	5.28–16.02	2.28***	1.48–3.53	1.02	0.56–1.85
DOS a few times a month	14.31***	8.57–23.88	2.31***	1.52–3.51	2.06**	1.21–2.99
Alcohol use by brother(s)						
Seldom	1	—	1	—	1	—
Few times a month	1.32	0.90–1.93	0.95	0.65–1.39	1.11	0.69–1.79
Few times a week	1.25	0.89–1.77	1.39	0.96–1.99	1.33	0.84–2.10
No additional brother(s)	1.05	0.80–1.39	1.07	0.83–1.39	1.40	1.00–1.96
Alcohol use by sister(s)						
Seldom	1	—	1	—	1	—
Few times a month	2.02***	1.43–2.85	1.41	0.98–2.04	1.19	0.74–1.93
Few times a week	2.39***	1.53–3.72	1.73*	1.04–2.85	1.29	0.70–2.39
No additional sister (s)	1.24	0.97–1.60	1.27	1.00–1.61	1.34	0.98–1.83
Alcohol use by friends						
No one drinks	1	—	1	—	1	—
A few drink	1.82***	1.30–2.55	1.49**	1.14–1.96	0.66*	0.46–0.95
More than half drink	8.56***	6.11–11.97	1.62**	1.18–2.23	0.74	0.49–1.13

Note. MZ = Monozygotic; DZ = Dizygotic same sex; DOS = Dizygotic opposite sex.
* $P < 0.05$.
** $P < 0.01$.
*** $P < 0.001$.
Nagelkerke $R^2 = 0.31$ for the cross-sectional model with age and sex; Δ Nagelkerke $R^2 = 0.29$ for the cross-sectional model with age, sex and drinking behaviour of family members and friends. Nagelkerke $R^2 = 0.41$ for the short term longitudinal model with age, sex and regular drinking 1993; Δ Nagelkerke $R^2 = 0.05$ for the short-term longitudinal model with age, sex, regular drinking 1993, and drinking behaviour of family members and friends. Nagelkerke $R^2 = 0.27$ for the long-term longitudinal model with age, sex and regular drinking, 1993; Δ Nagelkerke $R^2 = 0.04$ for the long-term longitudinal model with age, sex, regular drinking, 1993, and drinking behaviour of family members and friends.

showed a similar pattern as in the cross-sectional analyses for drinking of the co-twin, although odds ratios were lower. Results indicated that having a MZ, DZ same sex or DZ opposite sex co-twin who drank a few times a month or a few times a year in 1993 was associated with a higher risk for regular drinking 2 years later compared to having a

MZ co-twin who never or seldom drank. In contrast, in the long-term longitudinal analysis only, having a MZ, DZ same sex or DZ opposite sex co-twin who drank a few times a month in 1993 was associated with a higher risk for regular drinking, while drinking a few times a year by the co-twin in 1993 was no longer an association. Odds ratios indicated that participants with a MZ or DZ co-twin who drank a few times a month in 1993 were at higher risk for regular drinking than participants with a MZ co-twin who never or seldom drank. Having additional sister(s) who drank a few times a week marginally predicted regular drinking in the short term in 1995, this association disappeared in the long term. The odds ratio indicated that participants with additional sister(s) who drank a few times a week were at higher risk for regular drinking than participants with additional sister(s) who drank seldom. For drinking by additional brother(s) no associations over time were found. Short-term longitudinal analyses showed that having a group of friends among whom a few or more than half drank, increased the risk of regular drinking 2 years later, compared to having a group of friends among whom no one drank. In contrast, in the long run, having a group of friends among whom a few drank regularly decreased the risk of regular drinking after 7 years and the odds ratio of having a group of friends among whom more than half drank was no longer significant.

The short-term (1993–95) longitudinal model with alcohol use of parents, co-twin, additional siblings, and friends explained 46% of the variance of regular drinking and this was 31% for the long-term (1993–2000) longitudinal model. These were increases to the model with age, sex and regular drinking in 1993 of 5 and 4% respectively.

Additional analyses

In addition, interaction terms between variables on familial and friends' drinking and age and sex were tested. These analyses did not show significant interaction terms, either in the cross-sectional or in the longitudinal analyses, indicating that the relations between family and friends' drinking were not significantly different in 12–15-, 16–20-, and 21–25-year-olds, or in males and females.

To examine whether the results we found were biased by attrition or the fact that participants from the same family are not statistically independent, the analyses were repeated in a sample of participants who completed questionnaires at all three waves ($N = 1585$) and a sample of participants in whom only one twin was included ($N = 1880$). These additional analyses showed similar patterns as described previously.

DISCUSSION

We examined the relative role of parents', siblings', and friends' drinking on adolescents' and young adults' regular drinking. In general, alcohol use of parents showed small but persistent associations with drinking in their offspring in multivariate cross-sectional and longitudinal analyses, in particular for mothers. In the cross-sectional analyses, alcohol use of the co-twin was strongly associated with adolescents' and young adults' alcohol consumption, while alcohol use of additional brother(s) and sister(s) was relatively unimportant. Effects of drinking by the co-twin were persistent over 2 years and if co-twins scored relatively high on drinking behaviour, effects maintained after 7 years. In line with others (Engels *et al*., 1999; Andrews *et al*., 2002), we found that friends' alcohol use was also strongly associated with adolescents' and young adults' alcohol use. In cross-sectional analyses, it was still relevant in the prediction of individual drinking over a period of 2 years. However, over a period of 7 years' drinking by friends decreased the risk of regular drinking, but this effect was relatively small.

Moreover, our study showed that age and sex were important predictors of regular drinking. With regard to age differences, cross-sectional analyses indicated that 16–20- and 21–25-year-olds were at higher risk for regular drinking than 12–15-year-olds. But, the age effects in both longitudinal analyses indicated that participants who were 16–20 or 21–25 years old in 1993 were at lower risk to be regular drinkers in 1995 and 2000 than participants who were 12–15-year-olds in 1993. We expect that this age effect might be explained by the fact the older adolescents and young adults were more likely to have finished their studies and started working in 1995 and 2000. It might also be caused by changes in social roles, as previous research indicated that acquisition of a spouse role and a parental role was associated with a decrease in alcohol consumption (Hajema and Knibbe, 1998). Results with regard to sex differences were in line with previous studies that repeatedly indicated that males drink more as well as more often than females (e.g. De Zwart *et al*., 2000; Sutherland and Shepherd, 2001; Young *et al*., 2002).

The relative influence of mothers on regular drinking appeared to be stronger than that of fathers. Previous research has shown comparable effects of paternal drinking on their offspring's alcohol use (e.g. Chassin *et al*., 1996; Wood *et al*., 2004). However, it is crucial to understand that because of the relatively strong similarities in drinking between partners (so, parents) it is also possible that fathers are almost as important as mothers, but that in multivariate analyses, partly due to the correlation in drinking between parents, the effect of paternal drinking becomes invisible. Previous analyses of our data did not show differences in magnitude of relative risks for drinking in adolescents accounting for their father's and mother's drinking (Scholte *et al*., 2007).

Alcohol use of young people was to a relatively large extent associated with alcohol consumption of the co-twin, in particular in cross-sectional analyses. The analyses showed higher odds ratios for MZ twins than for DZ twins. This shows that genetic factors are relevant in alcohol use of young people, because MZ twins share all their genes identically by descent, while DZ twins share on average 50% of the genes. Classical twin studies have shown that environmental factors are relatively more important in predicting initiation of use in younger adolescents, while genes are more important in explaining continuation of use and more problematic use (e.g. Viken *et al*., 1999; Rhee *et al*., 2003). This seems to contrast our findings, which suggest that genetic factors become less important over time, because differences between odds ratios of MZ and DZ twins decreased over time, in particular for regular drinking. However, because different strategies of analyses used in classical twin studies and in the current study, comparison of results should be done with caution. Future

twin analyses on the data used in this study are required to draw conclusions on the relative influence of genes and environment on alcohol consumption.

Although alcohol use of the co-twin was one of the most important predictors of drinking among young people, the associations with drinking by the co-twin and drinking decreased over time. This might be explained by the fact that social contact within twin pairs decreased over time. At the first wave, the majority of the twins were still living with their co-twin (about 86%), but when the twins grew older a decreasing number of twins were living together (about 76% in 1995 and about 38% in 2000). Decreased social contact within twin pairs may contribute to decreased intra-pair similarity for alcohol use. Or it could be vice versa, decreased intra-pair similarity for alcohol use could cause less social contact within twin pairs, as it is unclear what the direction is in this relation (Kaprio *et al*., 1990; Lykken *et al*., 1990; Rose *et al*., 1990).

Small or non-significant associations were found between alcohol use of additional brother(s) and sister(s) other than the co-twin, and regular drinking in young people. In line with previous univariate analyses our data showed that drinking of, in particular, a MZ co-twin was a greater risk factor for drinking by adolescents than drinking by additional brother(s) and sister(s) other than the co-twin (Scholte *et al*., 2007). This might be explained by the fact that twins are of the same age and since alcohol use is highly age dependent, at least in the teenage and young adult years, twins may therefore be more similar in alcohol use than non-twin siblings. Closeness in age is also likely to result in spending more time together through adolescence. This will result in more shared experiences within the family environment, at school and with friends (Boyle *et al*., 2001).

We found that alcohol use of friends was strongly associated with regular drinking in cross-sectional analyses. Even in the short-term longitudinal analyses, in which we controlled for age, sex, own previous drinking and effects of family members, friends' drinking predicted adolescent and young adult regular drinking. However, in terms of explained variances (5 and 4% in addition to the model with age, sex and one's own previous drinking) we could not conclude that friends as well as family members strongly predicted adolescent drinking over time. Several recent studies argue that the role of friends in the development of substance use in young people might be less significant than is often assumed, because friendships could be formed on the basis of common alcohol use (peer selection) (Bauman and Ennett, 1996; Engels *et al*., 1997; Fisher and Bauman, 1988; Sieving *et al*., 2000; Andrews *et al*., 2002). Cross-sectional studies often interpret similarities in drinking in terms of influence processes, while in fact both selection and influence processes could be operating (Urberg *et al*., 2003). Jaccard *et al*. (2005) showed in a short-term longitudinal study that peer influence was limited if peer selection effects were controlled for. According to the authors, peer influences are often overestimated and are probably not more important than parental influences. Our results indeed show that drinking of friends was not more important than alcohol use of parents in predicting regular drinking. Because we did not know whether twins still had the same friends after 2 and 7 years we could not differentiate selection effects from influence. In addition, our analyses displayed some unexpected findings regarding the prediction of regular drinking by friends' alcohol use over a 7-year period. Having a group of friends among whom more than half drank alcohol, was cross-sectionally and short-term longitudinally related to a higher risk of regular drinking, but after 7 years a reverse trend appeared. This finding is in contrast with the hypothesis that being in a group of drinking friends will put people at a higher risk of regular drinking. A speculative explanation could be that being in a group of drinking friends at a certain point in time is related to frequent drinking at that specific time point. After a few years, these adolescents have ample experience with drinking and they might have matured out of drinking more quickly than adolescents who were not in a group of drinking friends a few years earlier.

A few limitations need to be mentioned. We used self-reports of parents and twins to assess regular drinking habits, but alcohol use of friends and additional siblings was reported by twins. This might have caused an overestimation of the effects of alcohol use of siblings and friends, since people tend to project their behaviour onto that of their friends and perceived reports on drug use may, therefore, correlate more than actual reports (Bauman and Ennett, 1996). Concerning friends' drinking, this might have played a role if we had found strong associations between friends' drinking and individuals' alcohol use over time. However, this was not the case. In 1995 there was a self-report from additional siblings as well as twin-reports over their sibs, and examination of these self-reports and twin reports on their additional siblings' alcohol use showed that these reports were highly correlated (correlations around 0.74, $P < 0.001$). This indicates that twins were capable of reporting on their siblings' alcohol use. Our results were probably not largely biased by overestimation of the effects of alcohol use of siblings and friends. In addition, drinking by family and friends was assessed in 1993 to predict drinking by twins in 1993, 1995 and 2000 respectively. It should be noted that, in contrast to relationships with family members, participants likely have formed new relationships with friends within the research period. These new friends might be of greater importance than the group of friends in 1993. This might have caused an underestimation of the (short-term) effects of friends on alcohol use. Moreover, this study was aimed at predicting regular drinking, therefore, our results might not be applicable to other indicators of drinking such as quantity of drinking.

Though explained variances ranged from 59% for regular drinking in the cross-sectional model to 31% for the long-term longitudinal model, the impact of drinking by family and friends on individual drinking was moderate to small (5 to 4% explained variance), in particular, in the longitudinal analyses. This indicates that there are other explanatory factors that were not included in this study. These may include personality (Hampson *et al*., 2006), more explicit peer pressure or direct imitation effects (Engels *et al*., 2007), and direct influences of parents, such as socialisation efforts (Jackson *et al*., 1999; Yu, 2003; Van Der Vorst *et al*., 2005). Future research should explore the relative role of these factors.

In conclusion, cross-sectional analyses showed that a substantial part of the variance in regular drinking of adolescents and young adults was explained by drinking by family

members and friends, in particular, drinking by co-twins and friends. However, drinking by family members and friends did not add much to the prediction of regular drinking in adolescents' and young adults' alcohol use over a 2- and 7-year period.

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